Historical Perspectives in the Care of Patients with Enterocutaneous Fistula

Jonathan B. Lundy, M.D.[1] and Josef E. Fischer, M.D.[2]

ABSTRACT

Evidence can be found throughout surgical history of how devastating an enterocutaneous fistula (ECF) can be for both patient and surgeon. From antiquity, this complication of abdominal surgery, malignancy, radiation, trauma, or inflammatory processes has been a significant challenge to surgeons due to high associated mortality and significant morbidity. An ECF causes dehydration, malnutrition, skin excoriation, and sepsis, and has profound psychological effects on the patient. Recent mortality rates of patients suffering an ECF approach 20%. The authors illustrate the history of management of patients with ECF and discuss advances in perioperative care including parasurgical care, nutrition, wound care, and the history of surgical techniques.

KEYWORDS: Enterocutaneous fistulas, historical review

Objectives: On completion of this article the reader should understand the evolution of care of the patient suffering from enterocutaneous fistulas to include perioperative care, nutrition, wound care, and surgical management

The word *fistula* is of Latin origin and means pipe, reed, tube, cane, musical pipe, or ulcer.[1] In a medical context, fistula means an abnormal connection between two epithelial-lined organs, and with a mortality approaching 20%, is one of the most devastating complications of abdominal surgery.[2] The written history of enterocutaneous fistulas (ECFs) can be traced back to the book of Judges in the Old Testament of the Bible in an account that describes a fistula that developed after Eglon was stabbed by Ehud.[3] Intestinal wounds were described in Hindu writings as early as 600 B.C.[4] Celsus observed that with small bowel injury only expectant care could be provided, but "the large intestine can be sutured, not with any certain assurance, but because this doubtful hope is preferable to certain despair."[5] Even as late as the 16th century, intestinal wounds were managed expectantly and patients either succumbed, healed, or suffered from an enterocutaneous fistula.[6]

Several anecdotes throughout early surgical history describe advances made by revolutionary surgeons that contributed to our current understanding of and ability to care for ECF. Amyand's historical appendectomy in 1736, which became known as his eponymous hernia, was for the treatment of a fistula in an inguinal hernia sac after the patient's appendix was perforated by a pin.[7] John Hunter reported his observations on fistula and a tendency for spontaneous closure if "the contents of the viscous become less" and advocated for wound care for the fistula patient.[5] The 18th century surgeon, Lorenz Heister, eloquently described his observations on the development of fistula after abdominal trauma in which he described "the lips of the intestines so wounded, would sometimes quite unexpectedly adhere

[1]United States Army Institute of Surgical Research, Fort Sam Houston, Texas; [2]Department of Surgery, Harvard Medical School, Boston, Massachusetts.

Address for correspondence and reprint requests: Jonathan B. Lundy, M.D., 3400 Rawley E. Chambers, Fort Sam Houston, TX 78234 (e-mail: jlundy1313@yahoo.com).

Enterocutaneous Fistulas; Guest Editor, Scott R. Steele, M.D.

Clin Colon Rectal Surg 2010;23:133–141. Published by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662.

DOI: http://dx.doi.org/10.1055/s-0030-1262980.

ISSN 1531-0043.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 SEP 2010	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Historical perspectives in the care of patients with enterocutaneous fistula	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Lundy J. B., Fischer J. E.,	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX 78234	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**9**	

to the wound of the abdomen."[8] Heister recommended that in the setting of intestinal injury, surgeons should learn from nature (i.e., an ECF) and the intestinal wound should be sewn to the edges of the abdomen. The field of ostomy surgery was hence born as a result of these astute observations on ECF. Surgeons such as Begny and Schafer adopted this method of exteriorization for intestinal trauma, and in 1783, Benjamin Bell modified the technique by creating a double-barreled ostomy to prevent stomal stenosis.[5,9] Bowel obstruction was also described as a cause of ECF. Cheselden, a surgeon at the Royal Hospital, Chelsea, recorded a case in 1783 in which a patient, Margaret White, developed a colocutaneous fistula at the site of a strangulated umbilical hernia, allowing her to live for many years with the inconvenience of fecal output at the umbilicus.[10] In Dupuytren's paper describing the use of his enterotome for the management of fistulas in 1828, he reported on 41 patients operated on with 38 survivors. Nine patients suffered from a recurrent fistula and he accurately summarized his frustration that later surgeons would experience with these failures by stating, "the discovery of a sure method of promptly achieving in all cases the healing of this disgusting malady would constitute one of the greatest steps of which the healing arts is capable."[11]

The introduction of aseptic technique, general anesthesia, and antibiotics between the mid-19th and 20th century allowed more frequent performance of abdominal surgery, and with it ECF from intentional and nonintentional intestinal injury became more prevalent. The remainder of this report will break down the history of care of patients with ECF into the advancements in perioperative care, nutrition and pharmacotherapy, wound care, and surgical techniques.

PERIOPERATIVE CARE

The late 19th and early 20th century literature contains several small case series and reports describing individual experiences with the management of ECF.[12–14] Surgeons commonly had to manage patients with concomitant severe emaciation, horribly excoriated perifistular skin, and uncontrolled sepsis. In addition, there was limited personnel with experience in the care of this type of patient, and as a result, mortality was remarkably high.[15] In 1960, Edmunds, Williams, and Welch reported a landmark publication of one of the first attempts to organize care of the ECF patient.[15] The authors from the Massachusetts General Hospital (MGH) reported the outcomes of 157 patients admitted from 1946 to 1959. Their report included gastric and duodenal fistulas as a result of elective surgical treatment for peptic ulcer disease. Although this entity has been virtually eliminated due to the success of medical therapy for *Helicobacter pylori*, back then it encompassed a significant source of morbidity and mortality.[16] Despite the introduction of antibiotics, the mortality in their series was not improved. However, Welch and colleagues were the first to recognize the importance of the relationship between infection, malnutrition, and fistula output with mortality. No patient in their series with diffuse output (defined as more than 100 mL/day) and malnutrition survived. Chapman, Foran, and Dunphy reported their experience with 56 cases of ECF treated at the University of Oregon from 1953 to 1963, which is revered as the first analysis to truly stress the importance of nutritional optimization.[17] The mortality rate was 12% if patients could tolerate 3,000 kcal/day compared with 55% if nutrition was suboptimal. They also organized management in priorities of treatment that evolved over time into the current phases of care of the fistula patient followed today.[18] Chapman's priorities of care included

- Phase 1: Management of dehydration, sepsis, and fistula effluent
- Phase 2: Initiation of electrolyte replacement and intravenous nutrition
- Phase 3: Placement of enteral feeding access and continued vigilance in the search for uncontrolled sepsis
- Phase 4: Major surgical intervention

The current phases of management of ECF encompass the acute and chronic problems these patients face.[18] Phase 1 involves fistula recognition and stabilization that includes control of sepsis, resuscitation of hypovolemia, and initiation of antibiotics. Wound care and fistula effluent control and quantification are also included in this phase. Pharmacologic attempts at reduction of fistula volume losses are made. Nutritional support is initiated to correct hypercatabolism and cachexia that are frequently present. Phase 2, or the investigational phase, involves imaging such as a fistulogram and computed tomography to determine anatomy and characteristics of the fistula. This includes ruling out intraabdominal abscess, defining fistula tract length and course, and determining bowel wall continuity or distal obstruction. The third phase—the decision phase—entails assessing the likelihood of fistula closure. This decision is made after sepsis is adequately controlled and nutritional repletion has taken place. The definitive management phase, phase 4 includes the operative intervention for management of the ECF. The final phase, healing, requires continuation of support to ensure success. Nutrition support is continued and physical and occupational therapy aids in restoration of function.

Advancements in the organization of fistula care have led to morbidity and mortality improvements illustrated in Soeters, Ebeid, and Fischer's 1979 report.[19] This 30-year, single-institution experience included 404 patients treated at the MGH. Groups of patients were

compared from three different periods. The first group included patients treated from 1945 to 1960, after the introduction of antibiotics; the second group treated from 1960 to 1970 experienced drastic improvements in parasurgical care, and the third group included patients treated from 1970 to 1975, after the introduction of hyperalimentation to the armamentarium. Mortality improved between the first and second groups, which was attributed to parasurgical care. This care included correction of electrolytes, support of respiratory and cardiac insufficiency, and the application of sound surgical principles. The third group of patients demonstrated a decrease in spontaneous closure rate and an increase in mortality as a result of the authors' institution becoming a major referral center for challenging cases.

Further evolution of care includes the development of specific centers dedicated to the care of ECF patients. The MGH reported its opening of a hyperalimentation unit in 1974 and reports of fistula/intestinal failure units began to appear in the literature in the early 1980s.[20,21] Irving's intestinal failure unit, first described in 1985 in the United Kingdom, reported its initial 3-year experience with 83 patients with various maladies, which included complex ECF.[22] The Hope Hospital Nutrition unit, which admitted other disease processes such as Crohn disease and short bowel syndrome, enjoyed a decrease in mortality from 42% to 21% after its inception. A more recent report by St. Mark's Hospital intestinal failure unit in 2004 described further improvements and reported a mortality rate of 10.8%.[23] Moreover, a recent review of Fischer's last 50 ECF patients in his personal series revealed no mortality using a standardized approach.[24]

NUTRITION

The importance of the optimization of nutrition in ECF patients is illustrated by referencing Chapman's observation that of high-output fistula patients, 81% healed and 27% died with adequate nutrition compared with only a 7% healing rate and 93% mortality with inadequate nutrition.[17] Further supporting the need for adequate nutrition in ECF patients are the findings by Fischer and colleagues that metabolic parameters to include short-turnover proteins, and in particular serum transferrin, have been shown to predict which patients will have favorable outcomes after surgical management of ECF.[25] Nutrition has revolutionized the care of ECF patients during the last half of the 20th century. Patients with fistulas were not always availed of such technologically advanced techniques for supplementing nutrition. In the 1920s and 1930s, administration of fluids to replete hypovolemic patients commonly included hypodermoclysis (subdermal injection of fluids) prior to the advent of intravenous (IV) catheters.[26] Patients intolerant of oral intake received dextrose containing compounds via a rectal drip, a process known as proctoclysis.[26] These techniques were far from adequate in their ability to replace ECF fluid losses, electrolytes, or nutrients, although they highlight how far we have come. The adverse results of malnutrition to include cachexia, pressure ulcers, skin erosion, muscle wasting, and failure of wounds to heal were well described leading up to the middle of the 20th century, but no ability to reliably improve this problem existed.[27]

The revolutionary technique of providing nutrition via the parenteral route was first described in 1939 in which 35 adults received IV casein hydroxylates, glucose, and saline as their sole source of nutrition for various disease processes.[28] In 1945 Brunschwig reported successful intravenous alimentation of a high-output fistula patient for 55 days.[29] Howard in a series of 25 patients reported upon in 1947, determined that protein IV administered was utilized in a similar fashion to orally administered protein.[30] Hull and Barnes described the first series of small bowel fistula patients treated with total IV alimentation in 1951.[31] The authors' formula for fluids administered was identical to Howard's. Patients received 4 L of fluid daily, which consisted of 3 L of 10% glucose solution and 1 L of casein hydroxylates. This formula provided 100 g of protein and 300 g of glucose, totaling 1600 kcal/day. Six patients were treated contributing to successful spontaneous closure of two fistulas and temporizing until surgical management could be performed in four. These initial reports of IV alimentation were in patients receiving nutrition via peripheral IV catheters. Development of silastic, vinyl, and polyethylene catheters and percutaneous techniques for accessing the superior vena cava simplified total parenteral nutrition (TPN) administration and allowed use of hyperosmolar formulas.[32] After demonstrating their data in Beagle puppies, Dudrick and colleagues from Philadelphia proved sustained meaningful restoration of malnutrition could be provided using TPN as the sole source of nutrition for long periods in children and adults with severe gastrointestinal (GI) dysfunction.[33,34] Dudrick's group described over 300 adults receiving IV alimentation for up to 210 days, achieving a maximum of 25 pounds of weight gain in one patient, positive nitrogen balance, and multiple instances of fistula closure. In addition, the group reported the addition of electrolytes, minerals, and trace elements to the mixture to optimize healing and growth. Dudrick later reported an astonishing 70.5% spontaneous fistula closure rate and 6.45% mortality with the use of IV alimentation alone.[35] Later reports confirm the fact that TPN has revolutionized the care of ECF patients by decreasing effluent volume and allowing for operation for fistula in a more elective setting; however, these reports do not conclude with the same mortality benefit described by Dudrick.[20,36] Advances in enteral nutrition include the development of

residue-free, elemental enteral formulas.[37] Interestingly, elemental diets originally came about as a result of space program research and the need to develop a diet that resulted in a minimal amount of feces.[38] Bury and colleagues in 1971, demonstrated that with elemental feeds, fistula effluent was decreased by 14 to 80%.[39] The use of elemental feeds also contributed to spontaneous fistula closure in seven of 13 patients in the authors' series. In 1972, Wolfe demonstrated that compared with standard canned feed, dogs fed an elemental diet or TPN achieved a reduction in small bowel output by 81% and 93%, respectively.[40] There is no doubt that the revolutionary contributions to the advancement of hyperalimentation by Dudrick and colleagues as well as various techniques of enteral nutrition noted above have contributed greatly to the area of nutritional support of the ECF patient. Yet its impact on having a direct effect on decreasing mortality remains controversial.[19,36] Currently, some clinicians make every attempt possible to resume enteral nutrition via the transoral or the nasoenteric tube route, or catheters placed into the distal limb of an ECF.[41] Others still advocate for complete bowel rest and effluent volume decrease, using TPN as an adjunct in the management of these patients.[42]

Pharmacotherapeutic adjuncts such as cimetidine and octreotide have undergone investigation for ECF patients. The histamine-2 (H2) receptor antagonist, cimetidine, first described for use as an adjunct in ECF in 1978, has been shown to decrease fistula effluent by 60% in proximal ECF by minimizing GI secretions.[36] The use of H2 receptor blockers and proton-pump inhibitors can decrease fistula effluent, prevent stress-induced gastritis, and reduce electrolyte losses, but have not been demonstrated to increase the rate of spontaneous fistula closure.[43–45] The naturally occurring gut hormone, somatostatin and its long-acting analog, octreotide have also been studied extensively as aids in decreasing ECF effluent and fistula healing.[46–48] Although most reports agree on the fact that these agents cause an acute decrease in fistula output, no reliable effect on spontaneous closure of ECF has been demonstrated.[48,49]

WOUND CARE

The care of wounds, skin, exposed bowel, and management of effluent present a tremendous burden to both the fistula patient and clinician. Small bowel effluent in direct contact with the skin results in breakdown of skin with excoriation, erythema, maceration, severe pain, and an unsightly wound. Techniques to care for these wounds are of both historical importance and are of interest to surgeons caring for ECF patients. Over time, clinicians have applied a variety of biologic dressings to ECF wounds including fresh egg whites, whole milk, and even fresh placenta.[49,50] Direct suctioning of effluent was one of the earliest advances in wound care for ECF patients and was first described by Erdman in 1921.[51] He devised a continuous suction apparatus suspended from a bed frame to control duodenal fistula output. Cameron placed an intraluminal suction device to control effluent achieving spontaneous closure in a duodenal fistula.[50] Potter first described the use of 1/10th normal hydrochloric acid, beef broth, and olive oil for proximal small bowel fistulas.[50] This mixture was thought to neutralize the alkaline effluent and provide a protein source other than skin for the pancreatic juice to digest. Warshaw directly infused hydrochloric acid into the fistulous tract and exchanged the beef broth for peptone to provide the protein substrate.[52] Potter later described the use of a Bradford frame to prevent any contact of the patient's skin with effluent while sleeping.[50] During awake hours, the patient was charged with using a glass-tipped rod attached to suction to prevent effluent from contacting the skin. The patient rested in the prone position on the frame which allowed effluent to dependently evacuate into a catch pan below the open portion of the frame.

Barrier protection was a further advance in wound care that has evolved greatly over the course of the 20th century. Smith and Christensen reported the use of kaolin powder for skin care in ECF.[53] Kaolin is a naturally occurring mineral composed of aluminum and silicon whose clay form has been used for multiple medicinal purposes. In 1932, CoTui reported the use of kaolin paste in 162 cases of perifistular excoriation.[53] The powder form ultimately was found to be more efficacious. Kaolin was described as a revolutionary advance in the care of ECF patients at a surgical address by Sir Arthur Burgess in 1931.[53] Skin care improved greatly with the introduction of karaya as a protective agent for the ileostomy patient in the 1960s.[54,55] Karaya powder and paste are produced from the dried gum of the Sterculia urens bush. Rupert Turnbull described the accidental discovery of karaya powder as a means to improve care for the ileostomate (and subsequently fistula patient) in 1952.[56] He describes spilling a can of a resident's dental powder into a cup of coffee. The coffee was immediately absorbed by the karaya and the wet concoction stuck to Turnbull's hand. He correctly concluded that the powder had the ability to absorb ostomy effluent and protect skin. An innovative technique to protect the skin in especially difficult fistulas involved the creation of an abdominal wall cast using a silicone polymer.[57] The silicone polymer was poured around the temporarily occluded fistula, lifted from the abdomen, then covered with karaya powder allowing for application of an ostomy appliance. One of the first synthetic barriers, Stomahesive (Convatec Inc., Britol-Myers Squibb, New York, NY), derived from pectin, gelatin, carboxymethylcellulose, and polyisobutylene, was first described in 1971.[58] Karaya was ultimately

found to be less useful than synthetic products such as Stomahesive due to the fact that breakdown of the glycerine-containing sheets occurred after 12 hours of being bathed in effluent and the sheets tended to be poorly adherent to skin.[5] Additionally, Stomahesive, unlike karaya, has not been reported to cause allergic skin reactions. Current barrier care includes a plethora of natural and synthetic liquid skin sealants, skin barrier powders, solid form barrier sheets, and pastes that can be individualized based on the patient's body habitus, fistula effluent characteristics, and location.

Negative pressure wound dressings have also been a recent advance in the wound care of fistulas.[59,60] These devices can protect the skin of patients with some of the most challenging ECF wounds when more simple devices do not suffice (Fig. 1). These complex wounds make up as much as 25% of recent series of patients describing wound care of ECF.[41] Concern has arisen, however, that the process of applying negative pressure in close proximity to bowel wall may contribute to the development of subsequent ECF and resultant increased mortality.[61]

One of the most important advances occurred in 1954, when Rupert Turnbull operated on Norma Gill, a patient suffering from ulcerative colitis.[56] Ms. Gill, who had cared for her mother in the past who had a permanent colostomy, was left with a permanent ileostomy. After her volunteer work caring for fellow ostomates, Turnbull hired Gill in 1958 as an ostomy technician. They later coined the term "enterostomal therapist."[6] Turnbull later opened the first enterostomal therapy school in 1961 with training initially being offered to people with ostomies.[6] Gill and later pioneers of enterostomal therapy—Katherine Jeter, Barbara Saunders, and Josephine Plant created a field of nursing that continues to train courageous and innovative nurses.[5] These nurses must create appliances/dams to pouch some of the most difficult fistulas to protect skin, collect and measure fistula effluent, control odor, and contribute to the maintenance of patient morale.

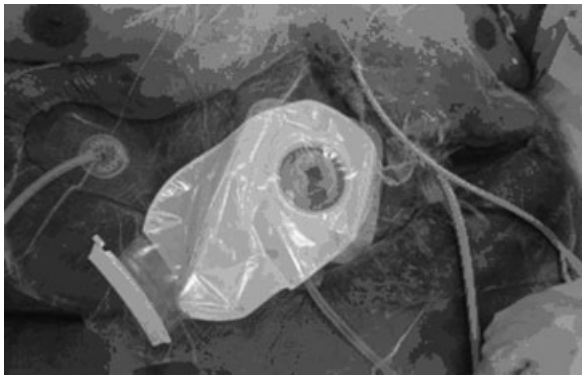

Figure 1 Complex posttraumatic abdominal wound with gastrocutaneous, enterocutaneous, and colocutaneous fistulas managed with negative pressure wound dressing.

SURGICAL INTERVENTION

Consistent with the above discussions, the surgical management of the patient with ECF is no less of a daunting task. Prevention was central to Senn's report discussing fistula as a complication of appendicitis in 1895 whereby he stated that early operation for appendicitis and correct ligature of the appendiceal stump were key.[12] Rushmore also emphasized early appendectomy for prevention of fistula.[12] Senn's insight even at the time was great, as evidenced by his recommendation that the initial management of the fistula patient should be nonoperative. Deaver published his thorough experience with fecal fistulas as a result of acute appendicitis whereby he provided a period of observation to determine the trajectory of fistula output before recommending operation.[62] Of 200 patients in his series, 37% healed spontaneously with a period of observation. A series of five patients by Haggard in 1918 described spontaneous closure of four fistulas associated with ventral hernias.[63] Dixon and Benson in 1946 advocated conservative management for fecal fistulas as densely adherent loops of bowel were thought to prevent generalized peritonitis, and patients were considered to be at risk for intraoperative trauma and worsening the situation.[64]

Several techniques for surgical intervention for ECF that were not widely accepted provide some interesting historical notes. Kappis described a double metallic button used for passage into the lumen of the bowel and occlusion of the fistulous opening.[65] In 1917, Mayo described the use of an oblong button passed through the fistulous tract into the lumen of the bowel.[66] This button was attached to a string that was secured at the abdominal wall surface and effectively occluded the fistulous tract. Once healing of the fistula was determined, the suture was cut and the button passed out of the fecal stream. Reybard described a similar wooden button with suture and Kleybolte recommended a button of leather to occlude the fistulous opening.[65] Baker described the use of a bismuth compound known as Beck's paste injected into the fistulous tract and reported the successful closure of a fistula with multiple treatments with the paste followed by instillation of a 5% formaldehyde in glycerin solution.[26] The Pauls tube was a right-angle tube available in three sizes that could be passed at operation into the afferent and efferent limbs of the diseased bowel.[65] A suture at the apex of the tube, which corresponded to the fistulous opening, was attached to a tongue depressor on the skin to assist with the maintenance of the tube's position. The tube allowed for the near complete passage of intestinal contents from proximal to distal.

Simple suture closure techniques were prevalent in early reports of surgical management of ECF. Perkins in 1896 reported a 16-year-old male with a proximal jejuna fistula managed initially with drainage of a right lower-quadrant abscess.[13] What Perkins initially

thought was a cecal fistula was ultimately found to be jejunal in origin, requiring elliptical excision of the tract and involved bowel wall with primary suture closure. Keyes also discussed simple suture techniques for fistula closure.[26] As late as Edmunds' report in 1960, simple suture "turn-in" was still described.[15] The initial description of the technique termed exclusion or bypass for fistula is credited to Trendelenburg's report in 1885.[27] This technique appeared frequently in the literature around the 1910s, one series being reported upon by Charles Mayo for the management of fecal fistulas.[14] Mayo's operation for "wet" cecal fistulas consisted of division of the terminal ileum proximal to the fistula, invagination of the cecum, and anastomosis of the proximal small bowel to transverse colon, achieving bypass of the fistulous segment of colon. Edmunds' report also described several variations on exclusion including a complete exclusion procedure (Fig. 2).[15] This included isolation of involved bowel, leaving this remnant as a mucous fistula, followed by anastomosis of normal bowel. Hollender's 1983 report, further classified exclusion as either bilateral if both ends of fistulous bowel are divided leaving an isolated mucous fistula, or unilateral if only one end of bowel is divided.[67] Keyes in 1942 and Harbison in 1950 were early advocates for resection of the diseased segment of bowel which was performed after an initial exclusion operation.[26,68] McKirkdie and colleagues went on to describe a

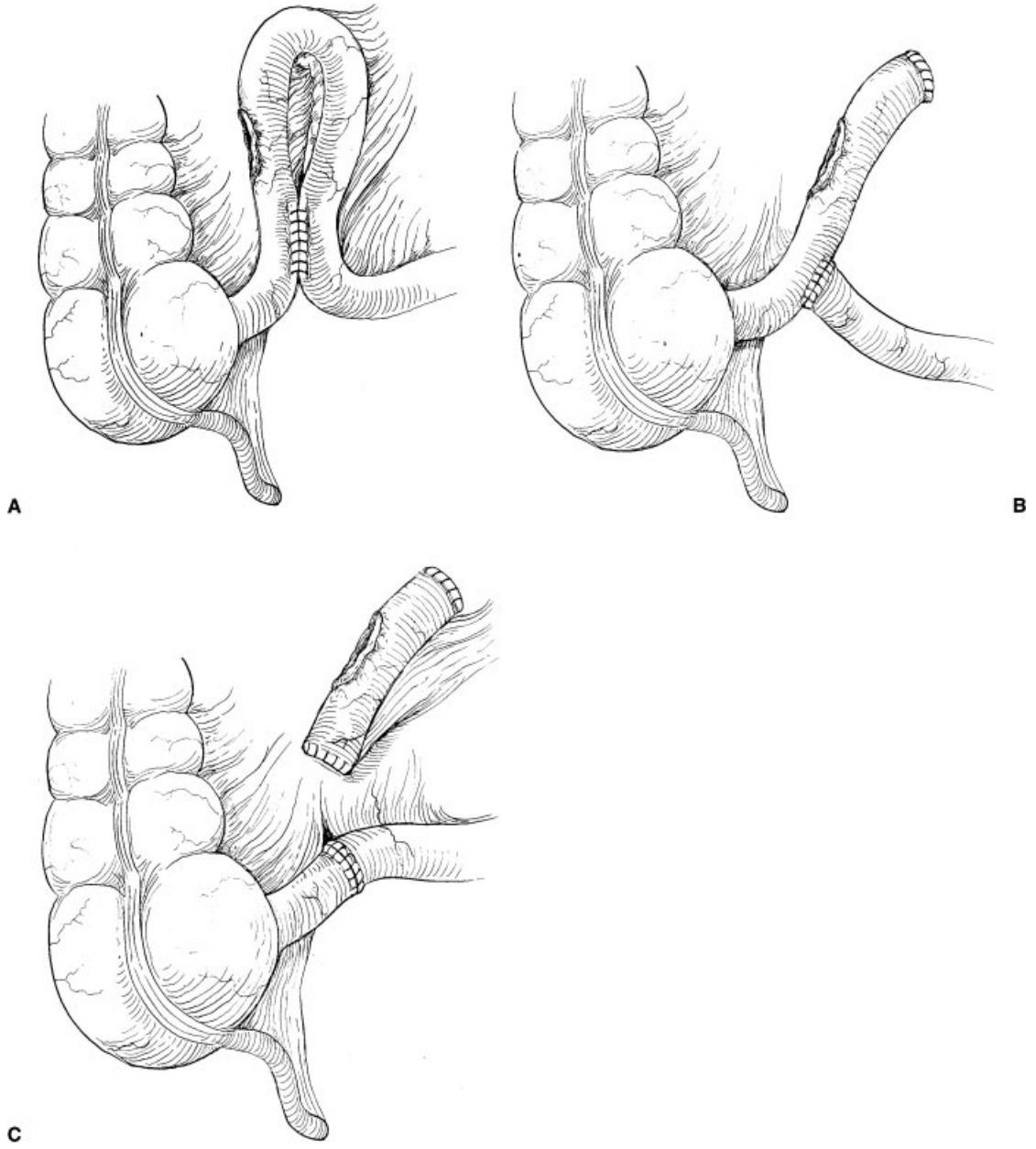

Figure 2 Techniques of exclusion procedures described by Edmunds and colleagues. (From Edmunds LH, Williams GM, Welch CE. External fistulas arising from the gastro-intestinal tract. Ann Surg 1960;152:445–471. Redrawn here.)

single-stage operation which entailed mobilization and resection of the diseased bowel followed by primary anastomosis when feasible.[69] Bowlin's large series of 79 fistulas, 15 of which were small bowel origin, also supported an approach of complete resection of diseased bowel.[70] Chapman, Foran, and Dunphy's landmark study provided further support for this surgical technique.[17] A modification of this technique was described by Goligher in 1971 and entailed exteriorization of bowel after resection of disease.[71] Reber, Way, and Dunphy in 1978 recommended resection but accepted that in certain situations, bypass or simple suture techniques may be required.[36] Soeters et al's 30-year review of the MGH experience strongly supported resection of the diseased bowel.[19]

More recent descriptions of less-invasive techniques for intervention are worth noting also. Fibrin glue, first described for use in patients with ECF in 1990, stimulates wound healing and potentially enhances fistula closure.[72] Fibrin glue has been used as early as 4 days after fistula presentation and multiple injections are typically required.[48,73] Bovine proteins in fibrin glue can cause allergic reaction, have the potential of prion transmission, and are associated with air embolism when injected under pressure.[48,74] Methods of fibrin glue instillation include direct injection at the external skin opening, transintestinal endoscopic administration, and via therapeutic fistuloscopy.[72,73,75,76] Diagnostic and therapeutic fistuloscopy is typically performed using a fiberoptic bronchoscope under fluoroscopic guidance and allows for direct tract visualization, irrigation, and occlusion using fibrin sealant.[74] Absolute ethanol sclerotherapy and injection of *N*-butyl2-cyanoacrylate-histoacryl have also been used to obliterate the fistulous tract.[77,78] A recent report described tract curettage followed by injection of an adipose-derived stem cell suspension and fibrin sealant in Crohn-associated ECF.[79] Materials inserted for fistula tract occlusion include gelatin sponge, Vicryl mesh plug, and acellular porcine small intestinal submucosa.[73,80,81] Intestinal defect patch techniques have been described when entry into the peritoneal cavity is unsafe and conservative measures are unlikely to be successful. Using the proximally detached rectus abdominus muscle, Chander et al successfully managed six ECF patients by suturing the muscle flap to the intestinal defect.[82] Tachi and Hirabayashi described a fasciocutaneous turnover flap whereby the cutaneous side is sewn directly to the intestinal lumen.[83] Bioprosthetic materials such as acellular human dermis have also been used as intestinal defect patches in patients with open abdomens.[84]

CONCLUSIONS

Here we review some of the more interesting and important historical landmarks in the care of ECF patients. The topics of perioperative care, nutrition, wound care, and surgical intervention are highlighted. Simple adherence to the principles that have resulted from the contributions of the legendary surgeons, clinicians, and nurses will provide for the greatest chance for success in the care of the fistula patient.

DISCLAIMER

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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